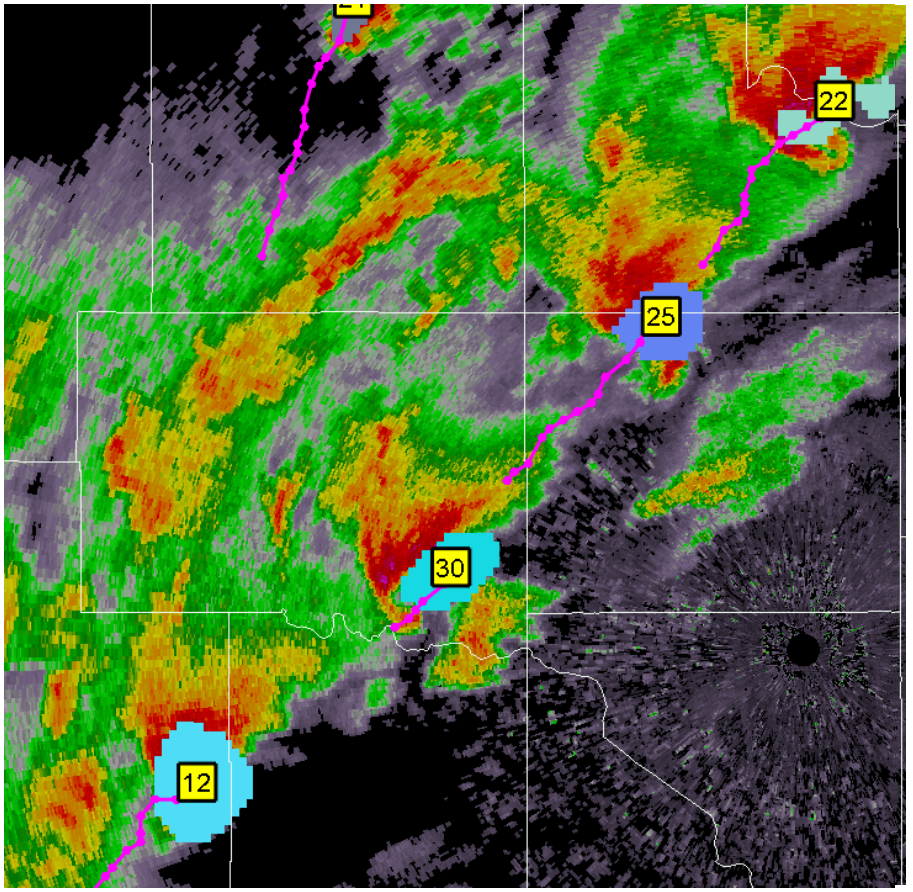
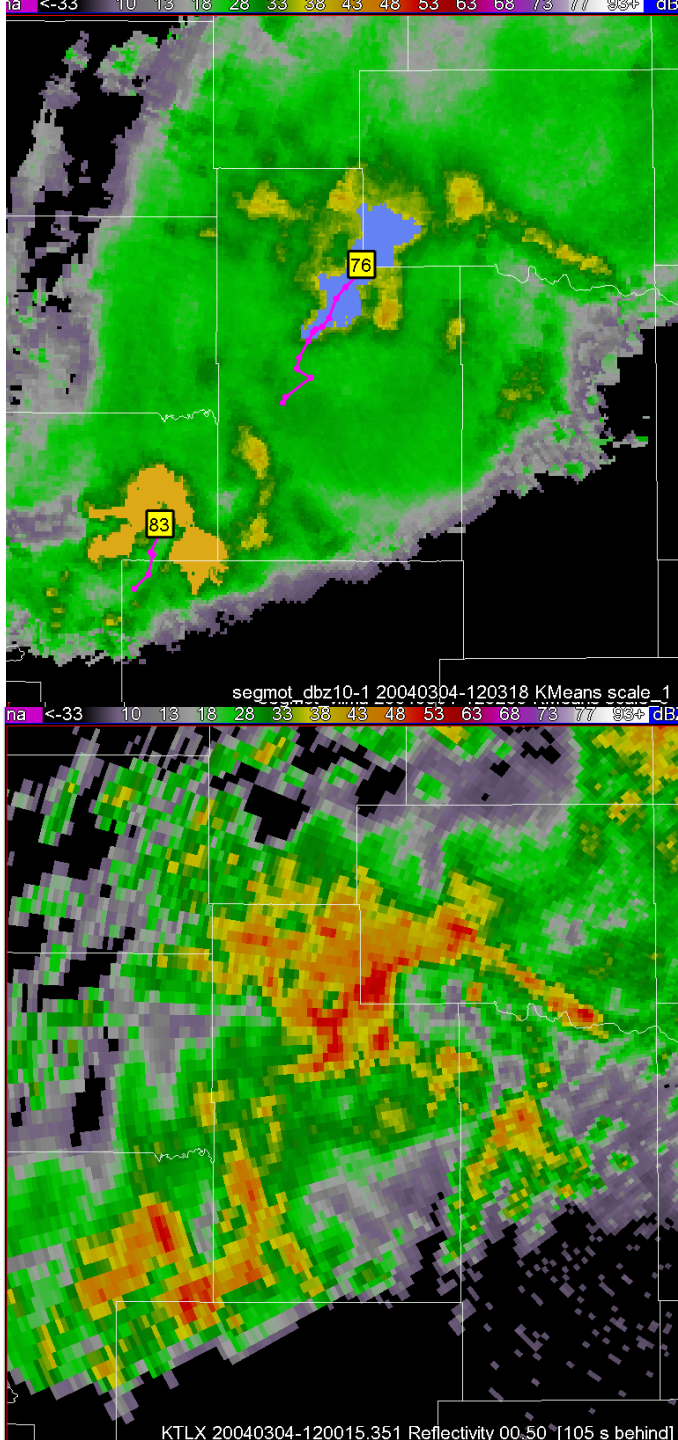
Storm Tracking and Lightning Cell Clustering using GLM for Data Assimilation and Forecast Applications



Principal Investigators:
Kristin Kuhlman and Don MacGorman
Collaborators:
Valliappa Lakshmanan, Ted Mansell, Travis Smith, and Kiel Ortega

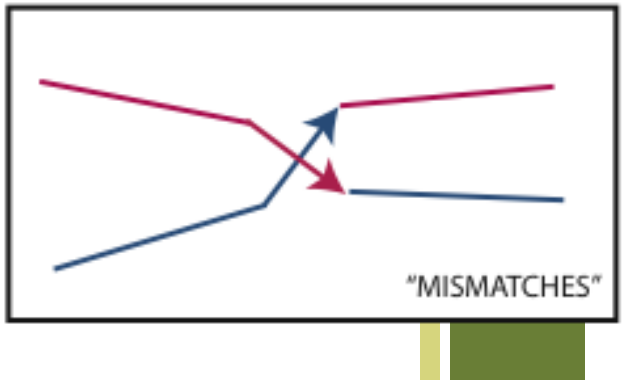
Segmotion/K-means

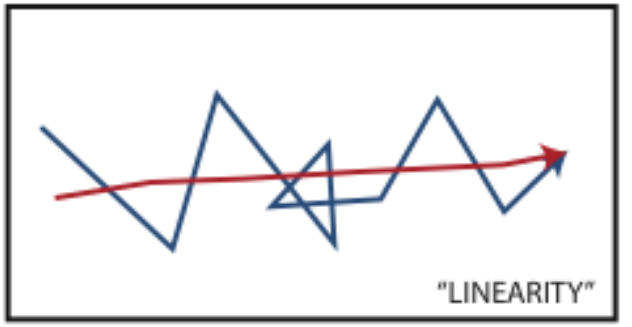
- Identifies **segments** (or storm cells/clusters) of image & estimates **motion**
- Extracts properties of each cell
  - Size of cell (# of pixels)
  - Pull data from all grids, including radar, lightning, and derived properties such as maximum expected size of hail (MESH)
- Moves grid based on motion field
- Tracking: Lightning vs. Reflectivity vs. Hybrid
- Want a relatively stable area, without drops or mismatches
- Past track given by centroid of area, if loses section or adds will change centroid location and can account for difference in track

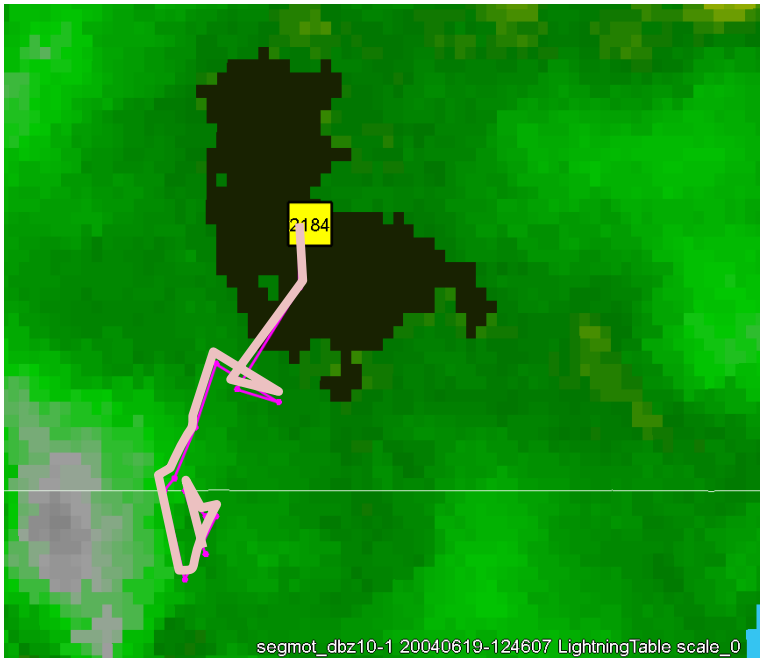


Comparison between methods

- Evaluating Track Duration (length), Linearity, and cell size
  - Better tracks are expected to be longer, more linear, and are consistent (less variability in cell properties)
- Both Lightning Density and Refl. @ -10 C provide consistent tracks for storm clusters / cells (and perform better than tracks on Composite Reflectivity)
- At smallest scales: Lightning Density provides longer, more linear tracks than Ref.
- Reverses at larger scales. Regions lightning tend to not be as consistent across large storm complexes.

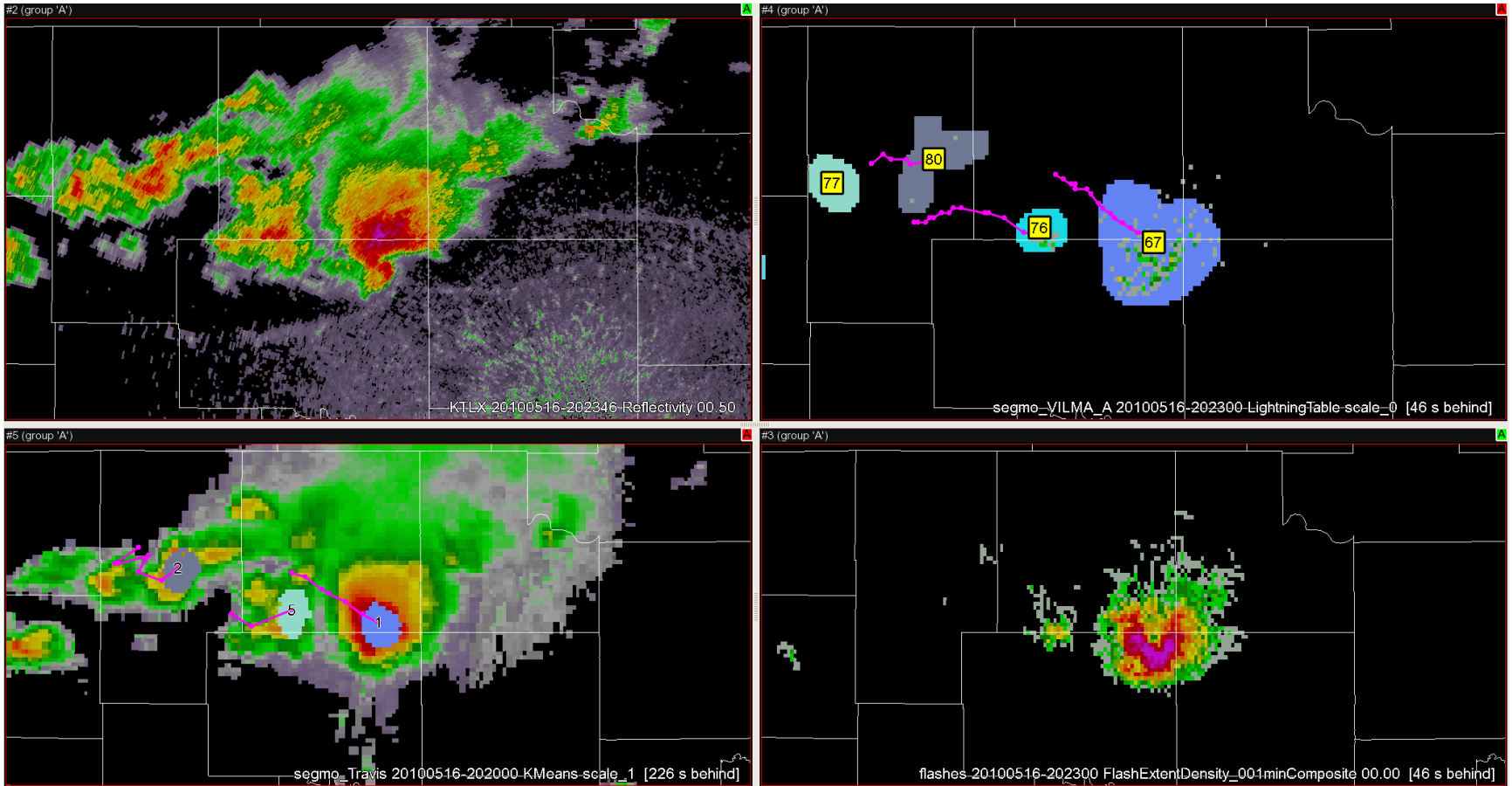


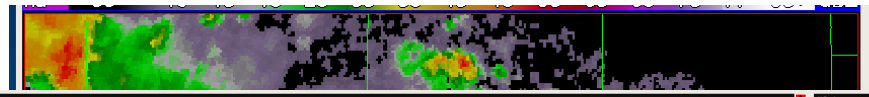




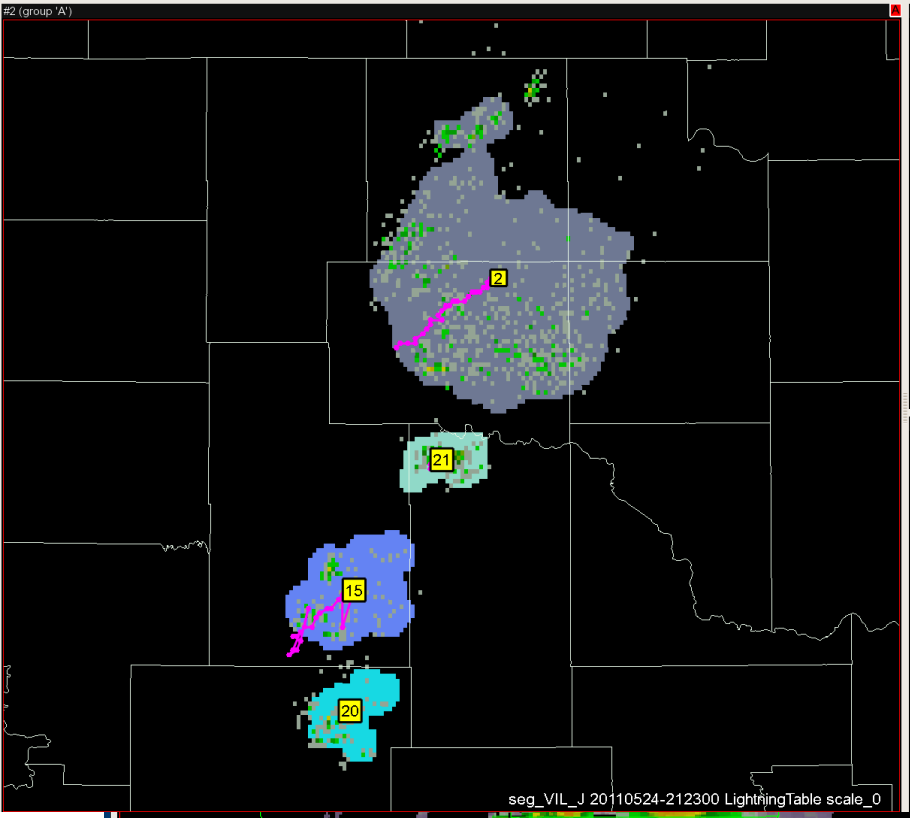
Questions:

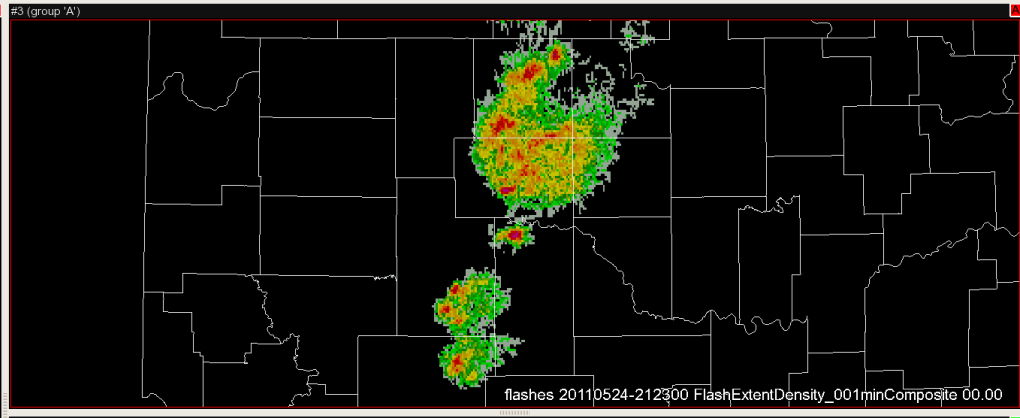
- For assimilation: # of flash initiations, # of flashes traversing a grid cell, or some measure of the summed density/duration of flashes at a particular grid cell?
- Are the answers to these questions different for different types of storms or at different resolutions/spatial scales?
- How does this translate to pGLM and ultimately GLM?

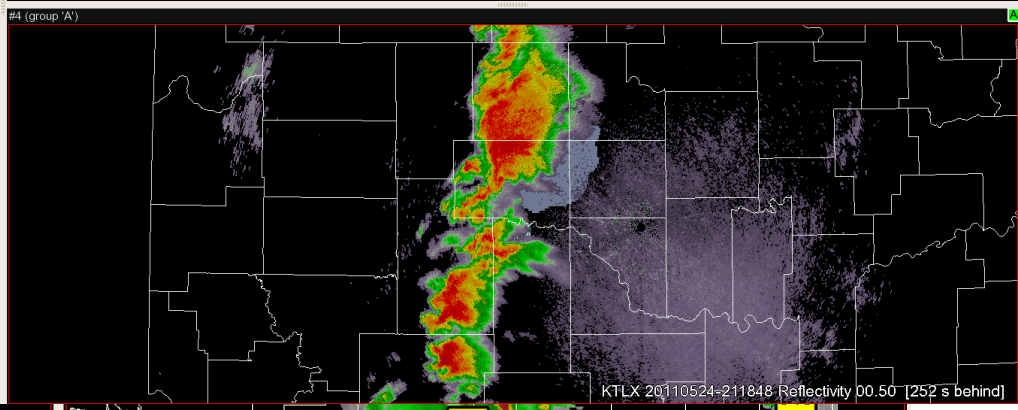


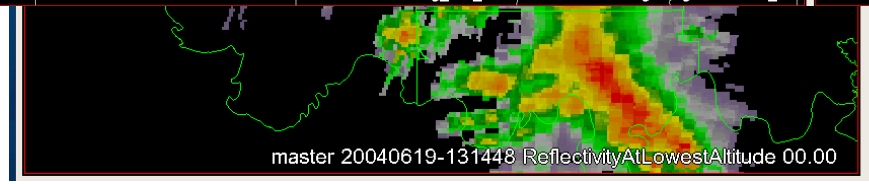


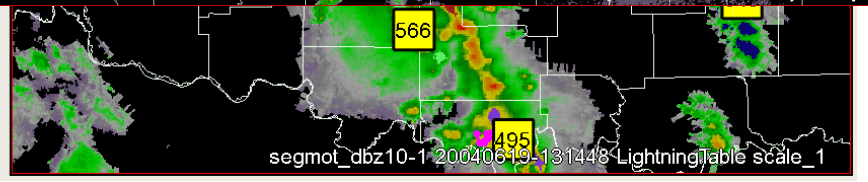

MD <1.0 1.5-3.0 5.0-7.5 10.0-15.0 30.0-40.0 75+ number/(min km^2)


#2 (group 'A')
2
21
15
20
seg_VIL_J 20110524-212300 LightningTable scale_0


#3 (group 'A')
flashes 20110524-212300 FlashExtentDensity_001minComposite 00.00


#4 (group 'A')
KTLX 20110524-211848 Reflectivity 00.50 [252 s behind]


master 20040619-131448 ReflectivityAtLowestAltitude 00.00


566
495
segmot_dbz10-1 20040619-131448 LightningTable scale_1